



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AONX38168A**

**25V Dual Asymmetric N-Channel XSPairFET**

### General Description

- Trench Power MOSFET technology
- Low  $R_{DS(ON)}$
- Low Gate Charge
- High Current Capability
- RoHS 2.0 and Halogen-Free Compliant

### Product Summary

	<u>Q1</u>	<u>Q2</u>
$V_{DS}$	25V	25V
$I_D$ (at $V_{GS}=10V$ )	60A	85A
$R_{DS(ON)}$ (at $V_{GS}=10V$ )	< 3.6mΩ	< 0.85mΩ
$R_{DS(ON)}$ (at $V_{GS}=4.5V$ )	< 5mΩ	< 1.15mΩ

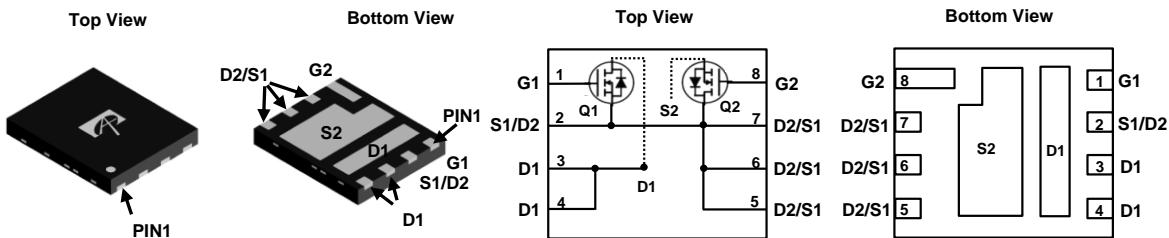
### Applications

- DC/DC Converters in PC, Servers
- Point of Load Converters

100% UIS Tested  
100% Rg Tested



**DFN 5x6E**



### Orderable Part Number

Orderable Part Number	Package Type	Form	Minimum Order Quantity
AONX38168A	DFN 5x6E	Tape & Reel	3000

### Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Parameter	Symbol	Max Q1	Max Q2	Units
Drain-Source Voltage	$V_{DS}$	25	25	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	$\pm 12$	V
Continuous Drain Current	$I_D$	60	85	A
$T_C=100^\circ C$		38	85	
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	180	340	
Continuous Drain Current	$I_{DSM}$	24	48	A
$T_A=70^\circ C$		19	38	
Avalanche Current <sup>C</sup>	$I_{AS}$	60	80	A
Avalanche energy $L=0.01\text{mH}$ <sup>C</sup>	$E_{AS}$	18	32	mJ
Power Dissipation <sup>B</sup>	$P_D$	20	69	W
$T_C=100^\circ C$		8	27	
Power Dissipation <sup>A</sup>	$P_{DSM}$	3.1	3.2	W
$T_A=70^\circ C$		2	2.1	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150		°C

### Thermal Characteristics

Parameter	Symbol	Typ Q1	Typ Q2	Max Q1	Max Q2	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	32	30	40	38	°C/W
Steady-State		60	55	75	68	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	4.8	1.45	6.2	1.8	°C/W

**Q1 Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	25			V
$\text{I}_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS}=25\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	$\mu\text{A}$
$\text{I}_{\text{GSS}}$	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 12\text{V}$			$\pm 100$	nA
$\text{V}_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1.3	1.7	2.1	V
$\text{R}_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=20\text{A}$		2.9	3.6	$\text{m}\Omega$
		$T_J=125^\circ\text{C}$		4	5	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=20\text{A}$		3.7	5	$\text{m}\Omega$
$\text{g}_{\text{FS}}$	Forward Transconductance	$V_{DS}=5\text{V}, I_D=20\text{A}$		220		S
$\text{V}_{\text{SD}}$	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.72	1	V
$\text{I}_S$	Maximum Body-Diode Continuous Current				20	A
<b>DYNAMIC PARAMETERS</b>						
$\text{C}_{\text{iss}}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=12.5\text{V}, f=1\text{MHz}$		1240		pF
$\text{C}_{\text{oss}}$	Output Capacitance			460		pF
$\text{C}_{\text{rss}}$	Reverse Transfer Capacitance			47		pF
$\text{R}_g$	Gate resistance	$f=1\text{MHz}$	0.6	1.3	2	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$\text{Q}_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=12.5\text{V}, I_D=20\text{A}$		16	24	nC
$\text{Q}_g(4.5\text{V})$	Total Gate Charge			6.9	12	nC
$\text{Q}_{\text{gs}}$	Gate Source Charge			2.8		nC
$\text{Q}_{\text{gd}}$	Gate Drain Charge			2		nC
$t_{\text{D(on)}}$	Turn-On DelayTime	$V_{GS}=10\text{V}, V_{DS}=12.5\text{V}, R_L=0.625\Omega, R_{\text{GEN}}=3\Omega$		6.2		ns
$t_r$	Turn-On Rise Time			2.6		ns
$t_{\text{D(off)}}$	Turn-Off DelayTime			21		ns
$t_f$	Turn-Off Fall Time			2.8		ns
$t_{\text{rr}}$	Body Diode Reverse Recovery Time	$I_F=20\text{A}, \text{di}/\text{dt}=500\text{A}/\mu\text{s}$		11.3		ns
$Q_{\text{rr}}$	Body Diode Reverse Recovery Charge	$I_F=20\text{A}, \text{di}/\text{dt}=500\text{A}/\mu\text{s}$		18.4		nC

A. The value of  $R_{\text{DJA}}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The Power dissipation  $P_{\text{DSM}}$  is based on  $R_{\text{DJA}} \leq 10\text{s}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design.

B. The power dissipation  $P_D$  is based on  $T_{J(\text{MAX})}=150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature  $T_{J(\text{MAX})}=150^\circ\text{C}$ .

D. The  $R_{\text{DJA}}$  is the sum of the thermal impedance from junction to case  $R_{\text{JJC}}$  and case to ambient.

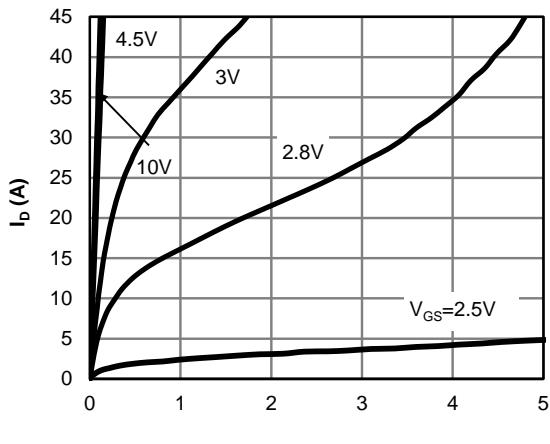
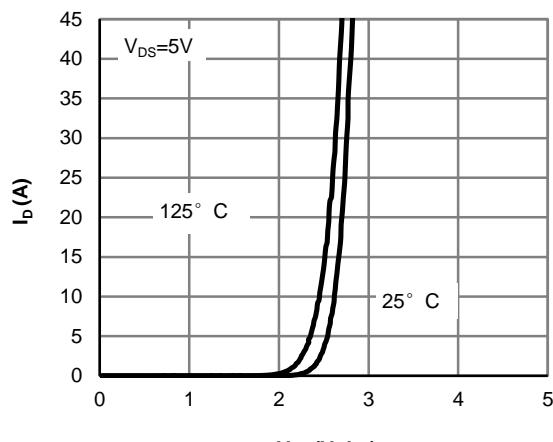
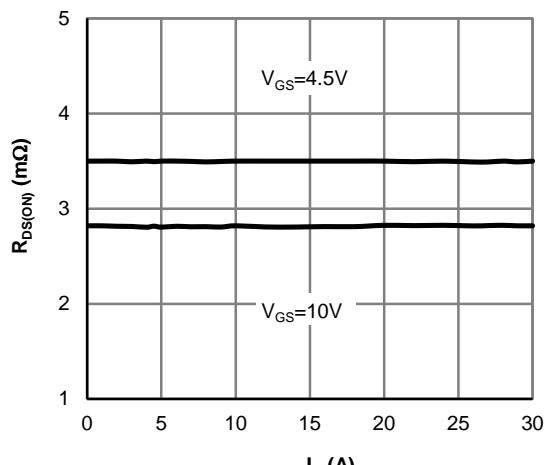
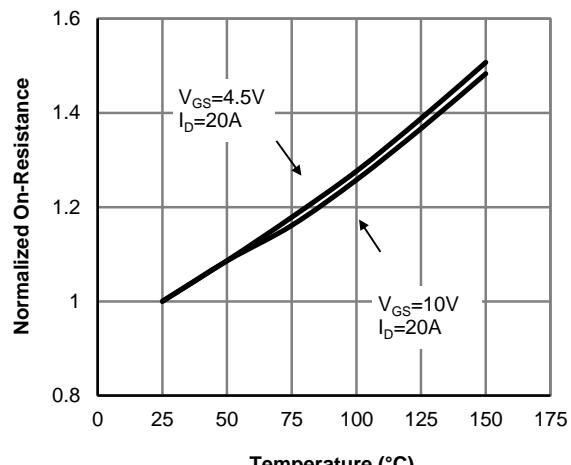
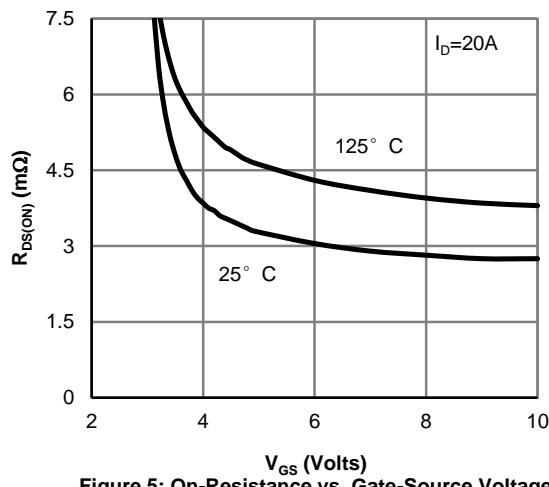
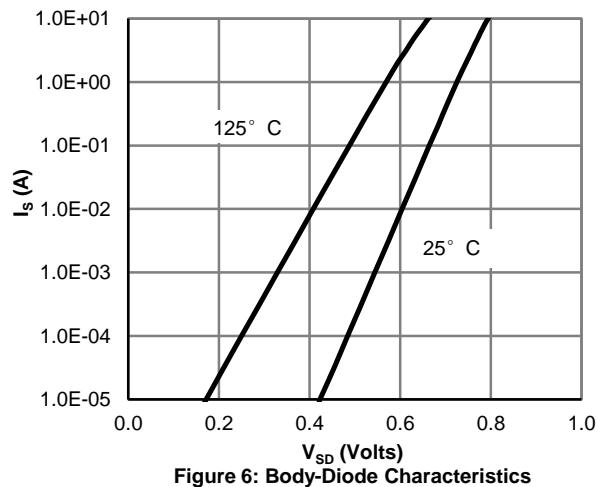
E. The static characteristics in Figures 1 to 6 are obtained using  $<300\mu\text{s}$  pulses, duty cycle 0.5% max.

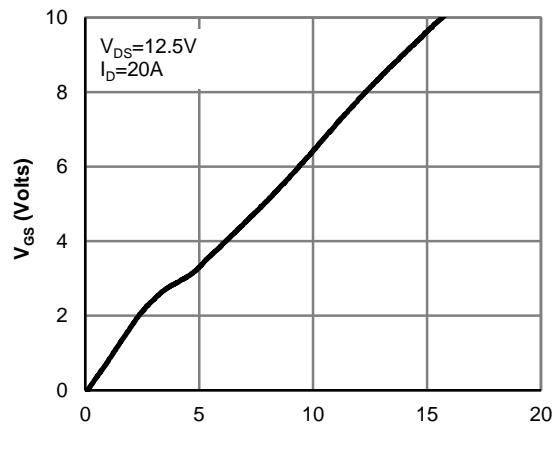
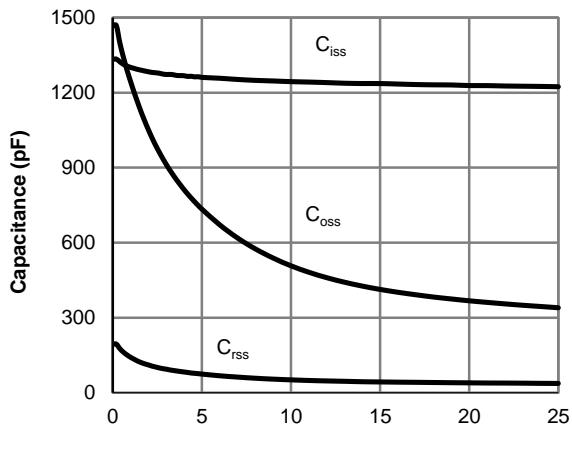
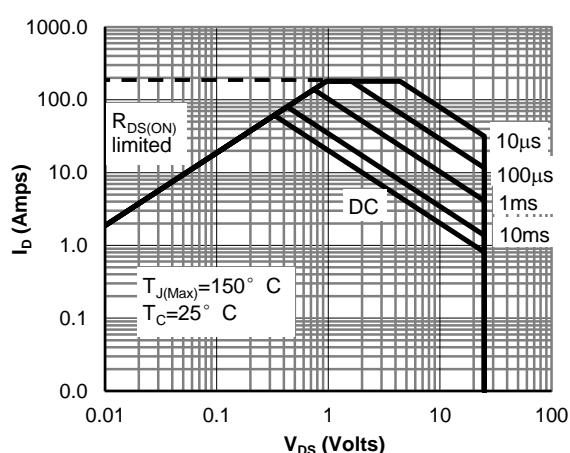
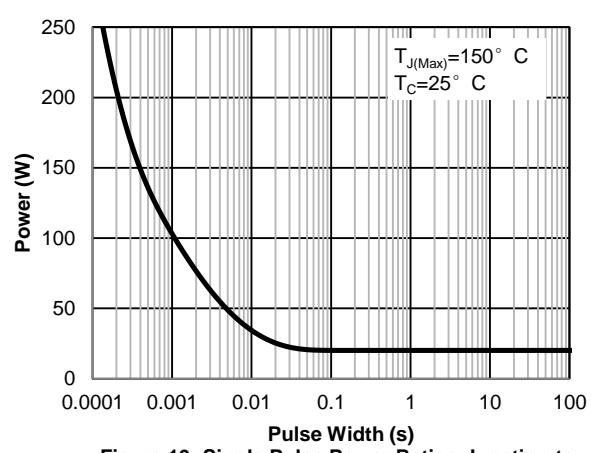
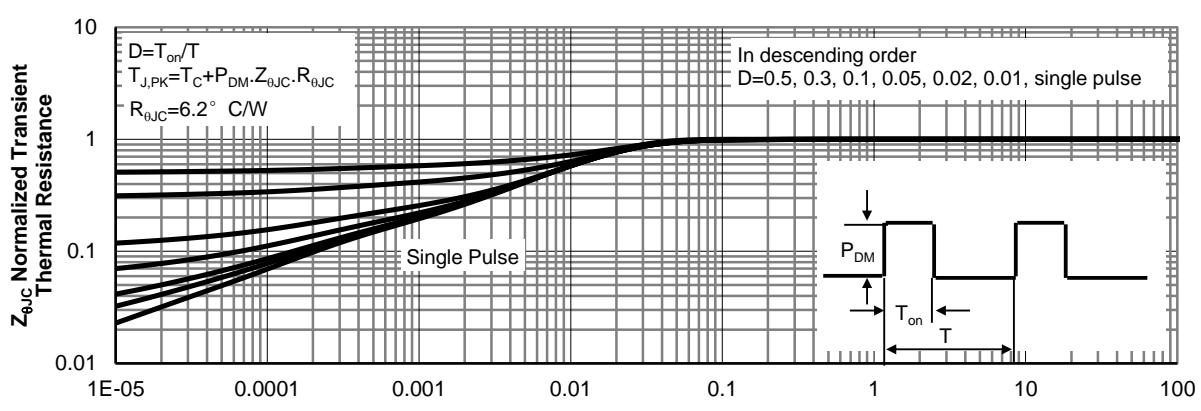
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{J(\text{MAX})}=150^\circ\text{C}$ . The SOA curve provides a single pulse rating.

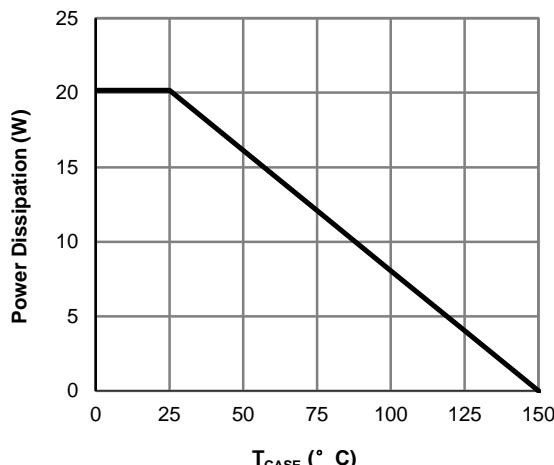
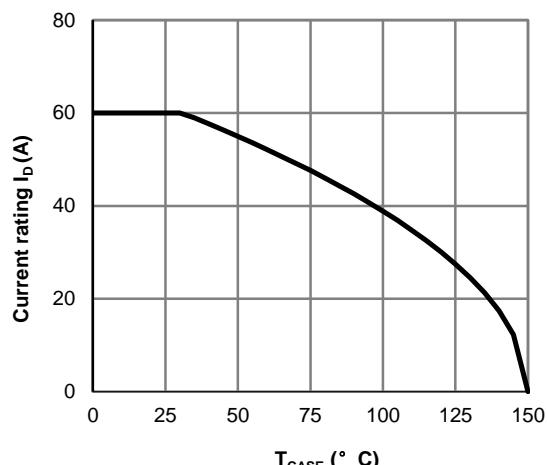
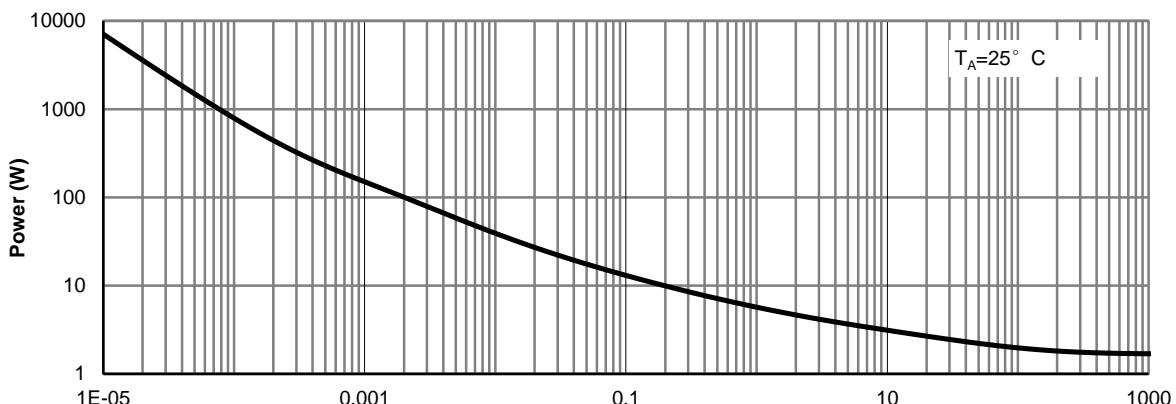
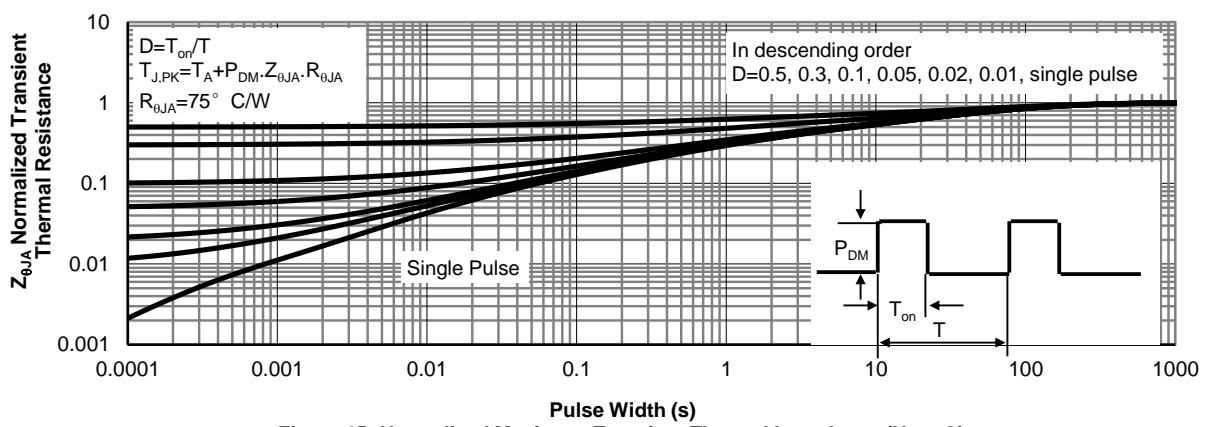
G. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ .

APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO MAKE CHANGES TO PRODUCT SPECIFICATIONS WITHOUT NOTICE. IT IS THE RESPONSIBILITY OF THE CUSTOMER TO EVALUATE SUITABILITY OF THE PRODUCT FOR THEIR INTENDED APPLICATION. CUSTOMER SHALL COMPLY WITH APPLICABLE LEGAL REQUIREMENTS, INCLUDING ALL APPLICABLE EXPORT CONTROL RULES, REGULATIONS AND LIMITATIONS.

AOS' products are provided subject to AOS' terms and conditions of sale which are set forth at:  
[http://www.aosmd.com/terms\\_and\\_conditions\\_of\\_sale](http://www.aosmd.com/terms_and_conditions_of_sale)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 1: On-Region Characteristics (Note E)**

**Figure 2: Transfer Characteristics (Note E)**

**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**

**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

**Figure 6: Body-Diode Characteristics (Note E)**

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 7: Gate-Charge Characteristics**

**Figure 8: Capacitance Characteristics**

**Figure 9: Maximum Forward Biased Safe Operating Area (Note F)**

**Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)**

**Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)**

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 12: Power De-rating (Note F)**

**Figure 13: Current De-rating (Note F)**

**Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)**

**Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)**

**Q2 Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	25			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=25\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm12\text{V}$			$\pm100$	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1	1.4	1.8	V
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=20\text{A}$ $T_J=125^\circ\text{C}$		0.73	0.85	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=20\text{A}$		1.05	1.2	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=5\text{V}, I_D=20\text{A}$	200			S
$V_{SD}$	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.67	1	V
$I_S$	Maximum Body-Diode Continuous Current				80	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=12.5\text{V}, f=1\text{MHz}$		4940		pF
$C_{oss}$	Output Capacitance			1330		pF
$C_{rss}$	Reverse Transfer Capacitance			130		pF
$R_g$	Gate resistance	$f=1\text{MHz}$	0.6	1.2	1.8	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=12.5\text{V}, I_D=20\text{A}$		60	85	nC
$Q_g(4.5\text{V})$	Total Gate Charge			25	35	nC
$Q_{gs}$	Gate Source Charge			11.6		nC
$Q_{gd}$	Gate Drain Charge			4.6		nC
$t_{D(\text{on})}$	Turn-On DelayTime	$V_{GS}=10\text{V}, V_{DS}=12.5\text{V}, R_L=0.625\Omega, R_{\text{GEN}}=3\Omega$		8.7		ns
$t_r$	Turn-On Rise Time			3.2		ns
$t_{D(\text{off})}$	Turn-Off DelayTime			56		ns
$t_f$	Turn-Off Fall Time			7.3		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=20\text{A}, \text{di}/\text{dt}=500\text{A}/\mu\text{s}$		20		ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=20\text{A}, \text{di}/\text{dt}=500\text{A}/\mu\text{s}$		53		nC

A. The value of  $R_{\text{JJA}}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The Power dissipation  $P_{\text{DSM}}$  is based on  $R_{\text{JJA}} \leq 10\text{s}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design.

B. The power dissipation  $P_D$  is based on  $T_{J(\text{MAX})}=150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature  $T_{J(\text{MAX})}=150^\circ\text{C}$ .

D. The  $R_{\text{JJA}}$  is the sum of the thermal impedance from junction to case  $R_{\text{JJC}}$  and case to ambient.

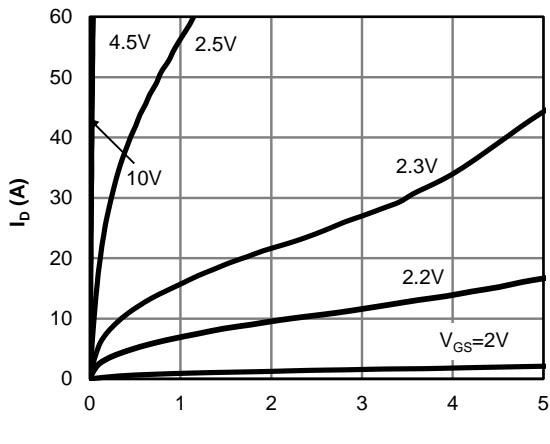
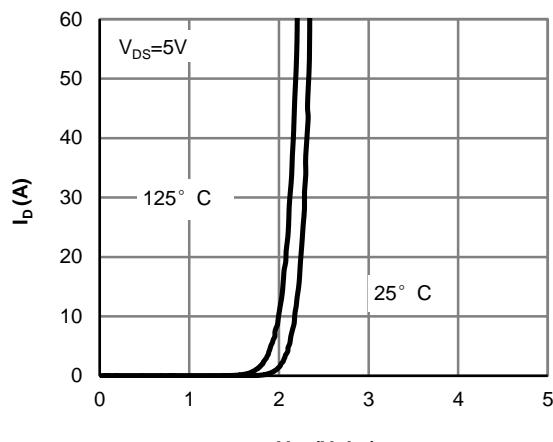
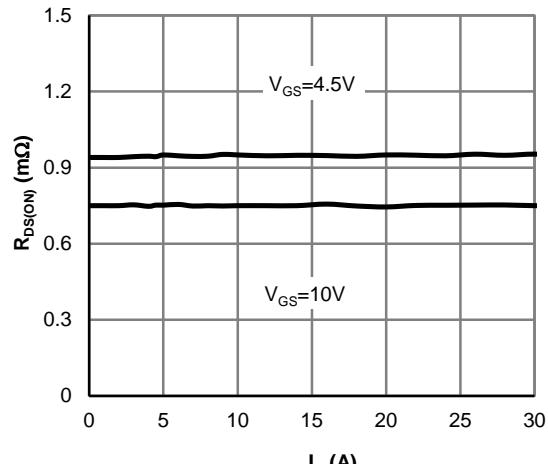
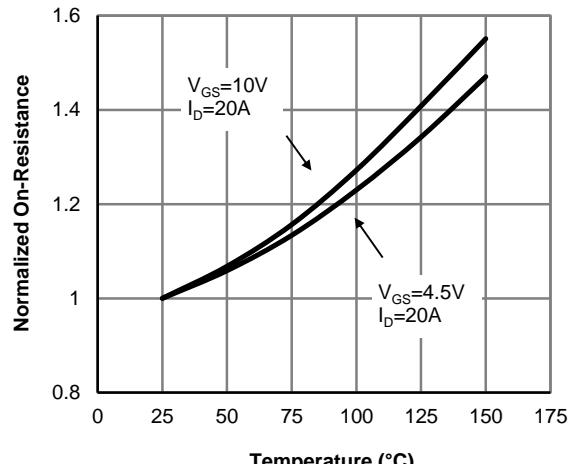
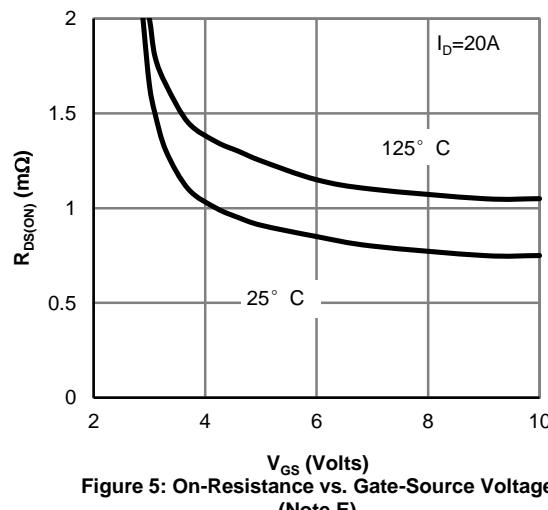
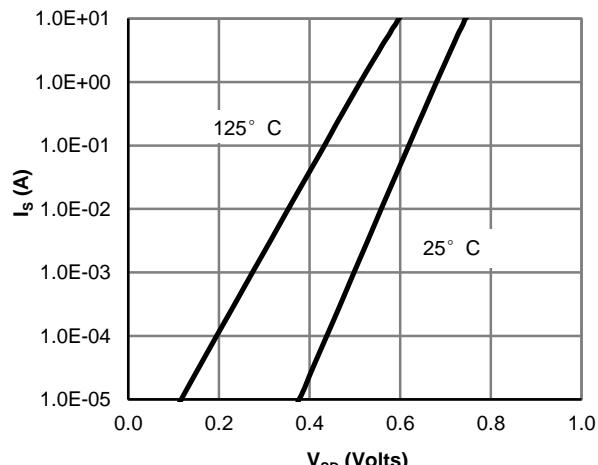
E. The static characteristics in Figures 1 to 6 are obtained using  $<300\mu\text{s}$  pulses, duty cycle 0.5% max.

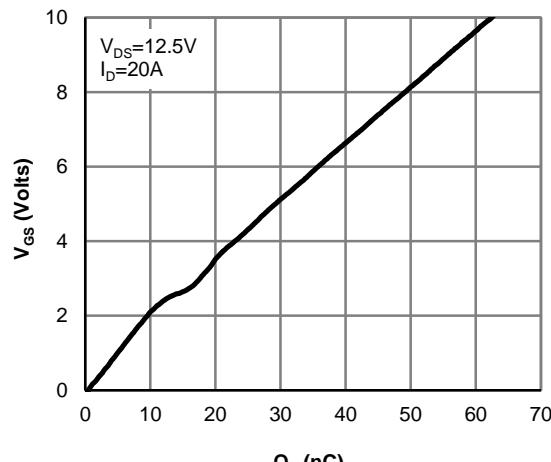
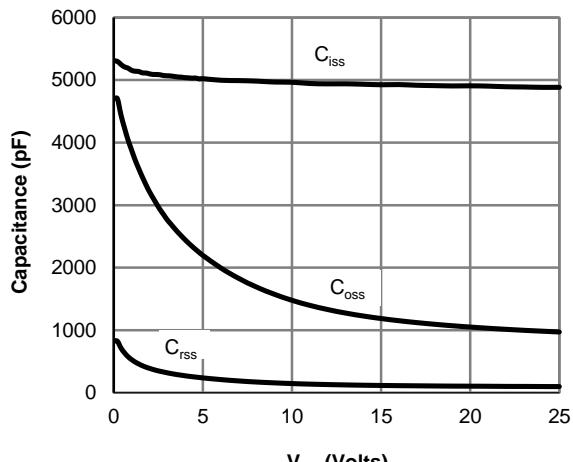
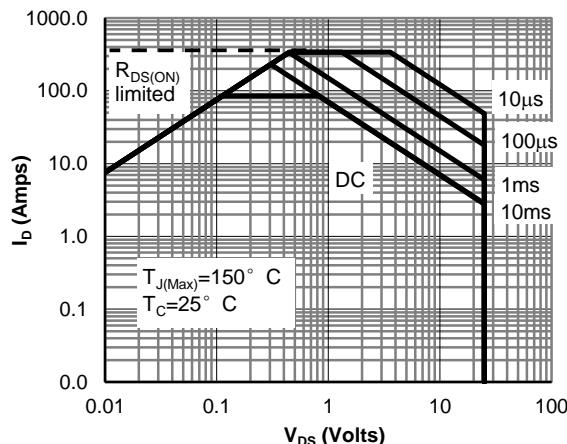
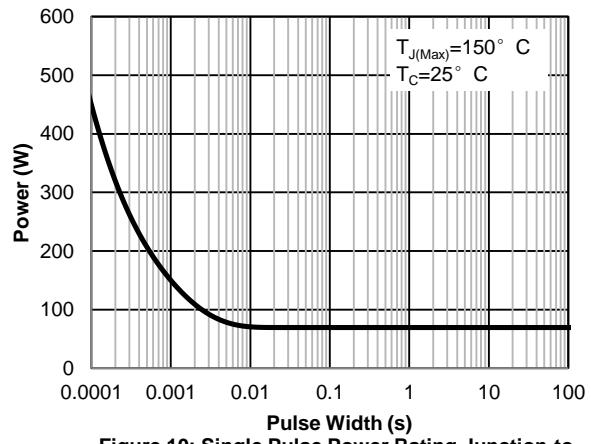
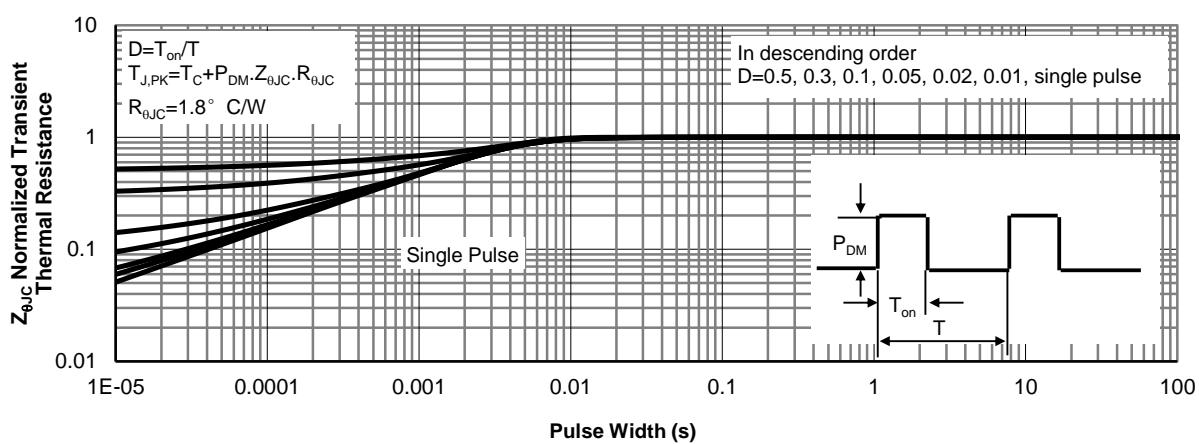
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{J(\text{MAX})}=150^\circ\text{C}$ . The SOA curve provides a single pulse rating.

G. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ .

APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO MAKE CHANGES TO PRODUCT SPECIFICATIONS WITHOUT NOTICE. IT IS THE RESPONSIBILITY OF THE CUSTOMER TO EVALUATE SUITABILITY OF THE PRODUCT FOR THEIR INTENDED APPLICATION. CUSTOMER SHALL COMPLY WITH APPLICABLE LEGAL REQUIREMENTS, INCLUDING ALL APPLICABLE EXPORT CONTROL RULES, REGULATIONS AND LIMITATIONS.

AOS' products are provided subject to AOS' terms and conditions of sale which are set forth at:  
[http://www.aosmd.com/terms\\_and\\_conditions\\_of\\_sale](http://www.aosmd.com/terms_and_conditions_of_sale)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 1:** On-Region Characteristics (Note E)

**Figure 2:** Transfer Characteristics (Note E)

**Figure 3:** On-Resistance vs. Drain Current and Gate Voltage (Note E)

**Figure 4:** On-Resistance vs. Junction Temperature (Note E)

**Figure 5:** On-Resistance vs. Gate-Source Voltage (Note E)

**Figure 6:** Body-Diode Characteristics (Note E)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 7: Gate-Charge Characteristics**

**Figure 8: Capacitance Characteristics**

**Figure 9: Maximum Forward Biased Safe Operating Area (Note F)**

**Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)**

**Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)**

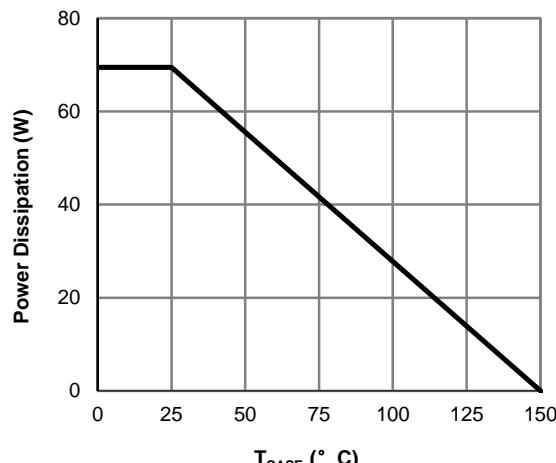
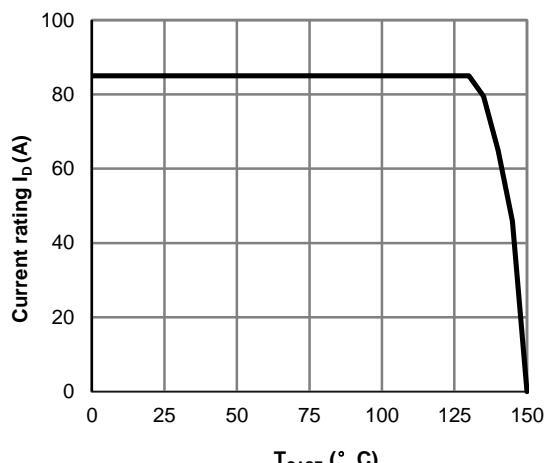
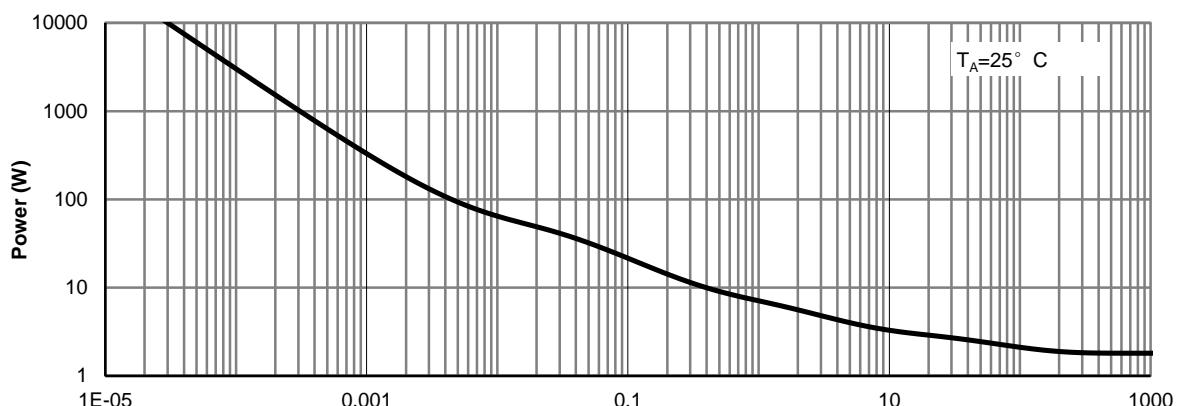
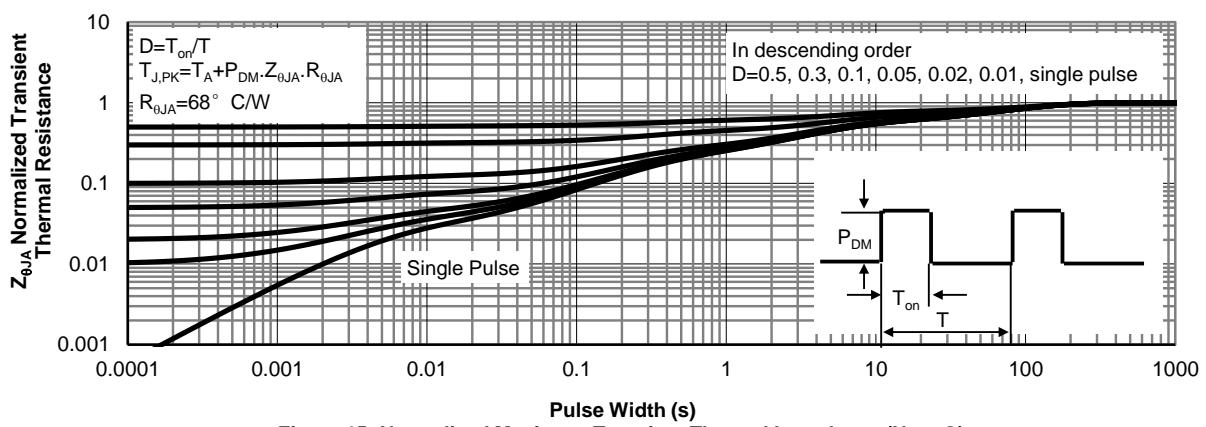
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 12: Power De-rating (Note F)**

**Figure 13: Current De-rating (Note F)**

**Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)**

**Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)**

Figure A: Gate Charge Test Circuit &amp; Waveforms

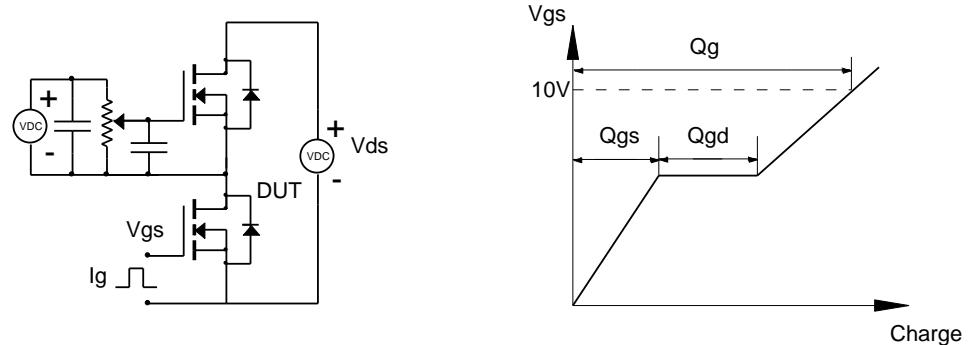


Figure B: Resistive Switching Test Circuit &amp; Waveforms

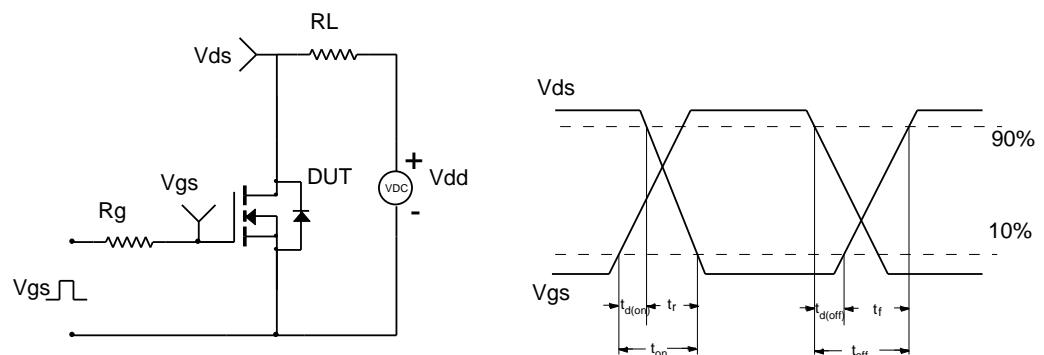


Figure C: Unclamped Inductive Switching (UIS) Test Circuit &amp; Waveforms

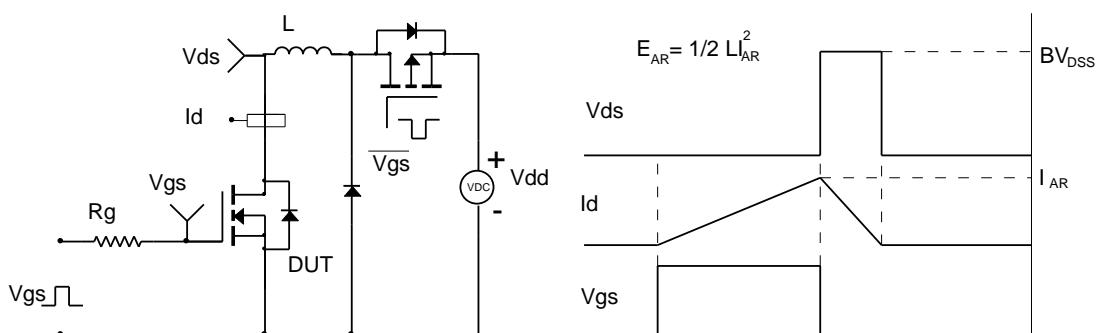


Figure D: Diode Recovery Test Circuit &amp; Waveforms

